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EXAMINER	
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ART UNIT	PAPER NUMBER
1792	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/595,203	SI ET AL.	
	Examiner	Art Unit	
	RAKESH K. DHINGRA	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 March 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 March 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *03/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 2 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In this case, claim 2 recites interalia "the inside of the chamber is symmetrical on the basis of a virtual line connecting the supply port and the exhaust port ------", whereas as per Fig. 1 of the applicant's disclosure supply port 160 and exhaust port 170 are not such disposed that these can be connected by a virtual line about which the inside of the chamber is symmetrical.

Applicant may clarify this in the drawing or amend the claim appropriately. For the purpose of examination on merits this claim limitation has been interpreted as presently recited in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention

was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 2, 4, 10, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Davis et al (US 2002/0144706) in view of Van Buskirk et al (US 5,741,363), Gadgil et al (US 2004/0129212) and Srivastava et al (US 6,761,796).

Regarding Claims 1, 4: Davis et al teach a remote plasma apparatus comprising a remote plasma source 41 (discharge tube) that supplies activated species to a process chamber 12 through a supply port 44 for processing a wafer mounted on a pedestal 18. Davis et al further teach a gas source 38 that supplies process gas and an exhaust port 48. Davis et al then teach the supply port comprises an inner plug 67 (made from ceramic) whose other end is closed, the diameter d3 of a closed portion of the other end being smaller than diameter d2 of the other end, and a gas spray hole 66b being formed in the side wall of the outer tube 66; and the outer tube 66 having one end which is opened such that the closed portion of the inner plug 67 is inserted in the one end, the other end of the outer tube being spaced apart by a predetermined interval from the other closed end of the inner tube. Davis et al additionally teach that the outer tube can have showerhead configuration at the output end. Davis et al also teach that the apparatus

can have microwave supply apparatus as plasma generation means (e.g. Figs. 2-7 and para. 0032-0036, 0060).

Davis et al do not teach a thermal source provided in the chamber and including a plurality of lamps for heating the wafer, the supply port and the exhaust port provided at both ends of the chamber, and wherein the supply port includes:

an inner tube having one end which is opened and connected to the discharge tube and the other end which is closed, the first spray hole being formed around a side wall of the closed portion of the inner tube; and

an outer tube having one end which is opened such that the closed portion of the inner tube is inserted in the one end, the other end of the outer tube being spaced apart by a predetermined interval from the other closed end of the inner tube.

Van Buskirk et al teach a gas supply port device comprising:

an inner tube 24 having one end which is opened and connected to a gas source 66 (similar to a discharge tube) and at the other end is disposed a baffle plate 18, and where the incoming gas is diverted sideways after contacting the baffle plate; and

an outer tube 16 having one end which is opened such that the one end of the inner tube 24 is inserted in the one end of the outer tube, and at the other end a plurality of second spray holes 20 are formed (e.g. Fig. 1 and col. 6, line 15 to col. 8, line 40). It would be obvious to replace the inner plug of Davis et al with an inner tube connected to discharge tube at one end and with the other end closed (similar to being covered with a baffle plate) as taught by Van Buskirk et al to obtain an efficient and uniform dispersion of the activated gas in the outer tube.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the supply port with inner and outer tubes, with the inner tube connected to discharge tube art one end, and having second end closed where the activated species are dispersed side- ways as

taught by Van Buskirk et al in the apparatus of Davis et al to obtain an efficient and uniform dispersion of the incoming activated gas species in the outer tube for supply into the process chamber.

Davis et al in view of Van Buskirk et al do not teach a thermal source provided in the chamber and including a plurality of lamps for heating the wafer, the supply port and the exhaust port provided at both ends of the chamber, and wherein the supply port includes: the first spray hole being formed around a side wall of the closed portion of the inner tube; and the other end of the outer tube being spaced apart by a predetermined interval from the other closed end of the inner tube.

Gadgil et al teach a plasma apparatus with a gas inlet (supply port) comprising:

An inner tube 306 with a first spray hole 306a around a side wall, an outer tube 304 having an opened end such that an end of inner tube is inserted therein and the other end of the outer tube 304 being spaced apart by a predetermined interval from the other closed end of the inner tube 306. Gadgil et al further teach that shapes, cross-section, pitch and direction of the gas supply (inlet) port are optimized to obtain a desired flow distribution on the wafer surface. It would be obvious to provide inner tube with hole in the side wall and with optimized shape and size of holes, and relative disposition of the inner and outer tubes (as result effective variables) to obtain desired flow distribution of active species over the wafer surface (e.g. Figs. 5A-5C and para. 0058-0062).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a first spray hole in the side wall of the inner tube and optimize the shape and location of gas outlet holes, and the relative disposition of the outer and inner tubes, as taught by Gadgil et al in the apparatus of Davis et al in view of Van Buskirk et al to obtain desired flow distribution of active species over the wafer surface.

In this connection courts have ruled:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Davis et al in view of Van Buskirk et al and Gadgil et al do not teach a thermal source provided in the chamber and including a plurality of lamps for heating the wafer, the supply port and the exhaust port provided at both ends of the chamber.

Srivastava et al teach a microwave remote plasma apparatus for photo-resist stripping comprising a processing chamber 16 with a thermal source comprising a plurality of lamps 58 and having supply and exhaust ports 51, 26 provided at both ends of the chamber (e.g. Fig. 1 and col. 3, line 55 to col. 6, line 15).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a thermal source comprising of lamps inside the chamber as taught by Srivastava et al in the apparatus of Davis et al in view of Van Buskirk et al and Gadgil et al to enable precisely control the temperature on the wafer surface.

Regarding Claim 2: Srivastava et al teach inlet and exhaust ports 51, 26 are arranged at side walls of the chamber 16, and inside of chamber is symmetrical about the inlet and exhaust ports, and the chamber bottom is formed parallel to the wafer (Fig. 1).

Regarding Claim 10: Davis et al teach the apparatus comprises a vacuum pump 50 and a discharge control valve 53a (Figs. 1, 2 and para. 0007).

Regarding Claim 11: Davis et al teach that the supply port 44 is designed so that divergent stream of activated gas is supplied over the wafer surface (para. 0034).

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Davis et al (US 2002/0144706) in view of Van Buskirk et al (US 5,741,363), Gadgil et al (US 2004/0129212) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4, 10, 11 and further in view of Sojoto et al (US 2002/0015855).

Regarding Claim 3: Davis et al in view of Van Buskirk et al, Gadgil et al and Srivastava et al teach all limitations of the claim except heating apparatus arranged around the supply port.

Sojoto et al teach a plasma apparatus with a chamber 112 that has a supply port 138 for receiving a heated gas delivery feed-through 140, having an inlet 142 and an outlet 144 to deliver one or more precursor gases into the gas distribution plate 126 mounted on the chamber lid assembly 114 (e.g. Fig. 3 and para. 0045).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a heating apparatus around the supply port as taught by Sojoto et al in the apparatus of Davis et al in view of Van Buskirk et al, Gadgil et al and Srivastava et al to enable control the temperature of the activated species for improved control of the plasma process.

Claims 5, 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Davis et al (US 2002/0144706) in view of Van Buskirk et al (US 5,741,363), Gadgil et al (US 2004/0129212) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4, 10, 11 and further in view of Zheng et al (US 2003/0066486).

Regarding Claim 5: Davis et al in view of Van Buskirk et al, Gadgil et al and Srivastava et al teach all limitations of the claim except length of supply port.

Zheng et al teach a plasma applicator with a chamber 430 that has a supply port 325 whose length is greater than the thickness of the wall of the chamber. Though Zheng et al do not explicitly teach the length of the supply port to be less than 100 mm, the same is related to functional limitations and would be selected (optimized) based upon process parameters like thickness of chamber wall, gas pressures, pumping speeds etc. (e.g. Figs. 3A-3C and para. 0072-0085).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the length of the supply port as taught by Zheng et al in the apparatus of Davis et al

in view of Van Buskirk et al, Gadgil et al and Srivastava et al as per process limitations like thickness of chamber wall, gas pressures, pumping speeds etc.

In this connection courts have ruled:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Regarding Claim 6: Zheng et al teach the supply port 325 can have a diameter of 1 inch which meets the claim limitation of 15-25 mm (para. 0098).

Claims 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Davis et al (US 2002/0144706) in view of Van Buskirk et al (US 5,741,363), Gadgil et al (US 2004/0129212) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4, 10, 11 and further in view of Mahawili (US 6,544,339).

Regarding Claim 7: Davis et al in view of Van Buskirk et al, Gadgil et al and Srivastava et al teach all limitations of the claim including a supply port connected 51 connected to microwave plasma apparatus, and the supply port 51 and the exhaust port 26 being oppositely arranged in a one to one correspondence in the chamber.

Davis et al in view of Van Buskirk et al, Gadgil et al and Srivastava et al do not teach at least two supply ports and at least two exhaust ports in the chamber.

Mahawili teaches a plasma apparatus with a chamber that has a plurality of supply ports and a plurality of exhaust ports. Mahawili further teaches that the configuration of supply and exhaust ports is optimized based upon required gas flow distribution and process uniformity consideration (e.g. Figs. 3-5 and col. 6, line 30 to col. 8, line 40).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the number and configuration of supply and exhaust ports in the chamber as taught by Mahawili in the apparatus of Davis et al in view of Van Buskirk et al, Gadgil et al and Srivastava et al as per process limitations like gas flow distribution and process uniformity requirements.

In this connection courts have ruled:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Claims 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Davis et al (US 2002/0144706) in view of Van Buskirk et al (US 5,741,363), Gadgil et al (US 2004/0129212) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4, 10, 11 and further in view of Toyoda et al (US PGPUB 2001/0029112) and Sawayama et al (US 2003/0164225).

Regarding Claim 8: Davis et al in view of Van Buskirk et al, Gadgil et al and Srivastava et al teach all limitations of the claim except an exhaust plate on which a cooling water path is formed is arranged on a side wall opposite to the side wall on which the supply port is provided, a wafer transfer port and the exhaust port being arranged at the exhaust plate 180.

Toyoda et al teach a plasma processing apparatus comprising a chamber 1, having a supply port 8A, 8B and exhaust port 9A, 9B provided at both ends thereof, with a wafer 4 being mounted in the chamber. Toyoda et al further teach an exhaust plate 7A that includes wafer transfer port (adjacent the gate valve 6) and the exhaust port 9A (Figs. 5, 6 and para. 0056-0061).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide exhaust plate with wafer entry port and the exhaust port as taught by Toyoda et al in

the apparatus of Davis et al in view of Van Buskirk et al, Gadgil et al and Srivastava et al to provide a compact unit for wafer entry and gas exhaust.

Davis et al in view of Van Buskirk et al, Gadgil et al, Srivastava et al and Toyoda et al do not teach the exhaust plate is water cooled.

Sawayama et al teach a plasma apparatus comprising a processing chamber 6001; an exhaust pump (rotary pump and mechanical booster pump) 6002 with exhaust pipe 6003, exhaust means 6018 and water cooling means 6021, a cooling means 6021 that uses water cooling the exhaust means 6018 (e.g. Fig. 30 and para. 0173). It would be obvious to provide the water cooling means as taught by Sawayama et al in the apparatus of Davis et al in view of Van Buskirk et al, Gadgil et al, Srivastava et al and Toyoda et al to enable control the temperature of the gaseous exhaust products and the temperature of the wafer.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide water cooling path on the exhaust plate as taught by Sawayama et al in the apparatus of Davis et al in view of Van Buskirk et al, Gadgil et al, Srivastava et al and Toyoda et al to enable control the temperature of the gaseous exhaust products and the temperature of the wafer.

Claims 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Davis et al (US 2002/0144706) in view of Van Buskirk et al (US 5,741,363), Gadgil et al (US 2004/0129212) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4, 10, 11 and further in view of Tay et al (US 6,075,922).

Regarding Claim 9: Davis et al in view of Van Buskirk et al, Gadgil et al and Srivastava et al teach all limitations of the claim including lamps 58 of thermal source that heat the wafer in an upward direction (Srivastava et al – Fig. 1) and a supply port 44 that is arranged so that process gas is sprayed in parallel with the wafer in the chamber (davis et al – Fig. 2).

Davis et al in view of Van Buskirk et al, Gadgil et al and Srivastava et al do not teach that lamps are arranged to emit light in a downward direction and that the lamps and the supply port are arranged such that a radiation region of light emitted from the lamps and a spray region of the process gas coincide with each other above the wafer.

Tay et al teach a thermal that includes a thermal source with lamps 26 that heat a wafer 14 in a downward direction (e.g. Fig. 1 and col. 6, line 15 to col. 7, line 20). Further, since the lamps 26 heat the wafer in a down ward direction and the supply port 44 of Davis et al supplies activated gas parallel to the substrate, a radiation region of light emitted from the lamps and a spray region of the process gas would obviously coincide with each other above the wafer.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide thermal source with lamps that emit light in a downward direction as taught by Tay et al in the apparatus of Davis et al in view of Van Buskirk et al, Gadgil et al and Srivastava et al to obtain heating of wafer simultaneous with the reaction process on the wafer surface.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rakesh K Dhingra/
Examiner, Art Unit 1792

/Karla Moore/
Primary Examiner, Art Unit 1792